REMARKS

A. Introduction

In the December 14, 2005 Office Action, claims 1-9 are noted as pending and are rejected based on prior art.

In this Response, new claim 10 is added, and remarks are provided.

B. The Present Invention

The following summary is to assist in the examination of the present invention, but is not intended to limit the scope of the claims.

The present invention relates to identifying objects within a plurality of objects, each object of which has an identical 3-D shape (e.g., flanged cylinders as shown in Figs. 1 and 2), but different positions and postures relative to each other (i.e., see again Fig. 1, the workpieces W piled randomly on top of one another). The goal is to be able to reliably and automatically pick objects, i.e., objects-of-detection or –interest, from this plurality.

Prior to being able to pick one of the objects-of-detection, a plurality of "reference models" is created and pre-stored in a memory, each reference model being based on an actual object-of-detection, or shaped identically to the objects-of-detection, and each being in an angular position relative to an axis of rotation. See, e.g., page 10, lines 4-26, page 11, lines 1-22, page 12, lines 9-24 and page 13, lines 7-22.

Further, the image capturing device views the objects-of-detection (see, e.g., page 14, lines 20-26 and page 15, lines 1-5) and a processor compares the captured position and posture information of the captured object-of-detection against the reference models and selects the reference model that best corresponds to allow the object-of-detection whose image has been captured, to be picked See, e.g., page 14, lines 15-19, page 15, lines 6-26 and page 16, lines 1-16.

In one embodiment, the position and posture information of the selected reference model is then used by the robot to pick the captured object-of-detection from the plurality of objects-of-detection. See, e.g., page 16, lines 21-24.

C. Rejection of Claims 1-9 Under 35 U.S.C. §103

These claims are rejected as being made obvious by a combination of U.S. Patent No. 4,680,802, of Nishida et al., and U.S. Patent No. 6,026,189, of Greenspan.

For the following reasons it is respectfully submitted that the present invention, as recited by claims 1-9, was not rendered obvious by the cited combination.

The present Examiner makes a particular point in contrast to the prior Examiner, i.e., that Nishida et al. teaches 3D object imaging. With all due respect, it is Applicant's position that one of ordinary skill, upon reviewing Nishida et al., would not be taught three-dimensional object imaging as recited herein.

As described expressly in Nishida et al., the recognition of the position and posture of the component parts is performed two-dimensionally. For instance, column 2, lines 14-27 of Nishida et al., which is cited by the Examiner, expressly states that "the component parts assume two-dimensionally arbitrary positions and postures on the truck."

In this regard, the image of the component parts in Nishida et al. is captured when they are scattered two-dimensionally on the truck portion of the rotary parts feeder (1) and not when they are piled on the disc portion of the rotary feeder (1). That is, as described at column 2, lines 9-27, the component parts are supplied and pile up on the disc at the center of the rotary parts feeder (1). Then, the component parts on the disc are supplied to the truck around the outer periphery of the disc of the feeder (1) and the component parts take "two-dimensionally arbitrary positions and postures on the truck." In order to pick up the component parts, it is necessary for the assembly robot (5) to recognize the two-dimensional directions of the component parts on the truck. Accordingly, one of ordinary skill is taught that the image processing carried out by Nishida et al. only recognizes the two-dimensional directions of the component parts.

In light of the above, and particularly since claim 1 recites at least using three-dimensional shapes for image processing, it is respectfully submitted that Nishida et al. fails to render obvious claims 1-9. Also, even if Greenspan taught the use of 3D for image processing, Nishida et al. does not require same as discussed above, and/or Greenspan fails to suggest how or why Nishida et al. would be modified to use 3D considerations, as discussed more fully below.

Further, the most recent Office Action did not address other recitations of the pending independent claim 1, as discussed below.

Nishida et al. does use a camera to view a plurality of objects, but same are of arbitrary shapes. See, e.g., Col. 1, line 39 and Col. 5, line 9. To compare against the present invention where only identical shapes, e.g., flanged cylinders, are used both for the reference object to create the reference models, and the objects-of-detection for picking up by the robot, Nishida et al. appears to use different shapes, which might be flanged cylinders, threaded nuts, washers

and threaded bolts. Thus, with the present invention, wherein all of the components including the reference object and the objects-of-interest are identical, once the reference models are created and stored, based on a rotated reference object, all that needs to be done is to capture and compare the objects-of-detection with the pre-set and pre-stored reference models.

More particular to the stored reference models, again they are created based on the angular rotation of the reference object relative to an axis or rotation. For example, see Figs. 2a-2d of the present application which show zero degree, 30 degree, 60 degree and 90 degree reference models. See also, e.g., Page 10, lines 16-26 and Page 11, lines 1-15 of the present specification.

In contrast, with Nishida et al. the shape of each arbitrary object-of-interest must be detected and compared against pre-stored parameters, which parameters are different than the angular rotation of an identical shape relative to an axis of rotation. The parameters are "hole position", "major axis direction", "remotest point" and "ultimate value pattern" (as shown in Fig. 4 of the reference and described at, e.g., Col. 3, lines 1-33), and these parameters are used in various combinations to create eight "types" (kinds) and postures of the shapes. These parameters generally entail reliance on a "center of gravity" (see, e.g., Col. 3, lines 19, 26 and 28) and in one case the "inertia" is considered (Col. 3, line 23), which hardly correspond to the angular orientation of an object relative to a pre-set axis of rotation, as recited herein. Thus, while position and posture may be used in Nishida et al., they are based on different parameters.

The Examiner suggests that Nishida et al. can merely dispense with the step of detecting the shape of each object. However, there is simply no suggestion in Nishida et al. of dispensing with the shape determining step. Nevertheless, dispensing with this step would not appear to be possible. Since the 2D shapes are different and the above-four described parameters appear dependent upon the shapes, it would appear Nishida et al. would have to evaluate the shape of each object before it could conclude that all the objects are of the same shape.

Further, Greenspan also at least does not rely upon identically-shaped reference objects and objects-of-interest, does not create a plurality of reference models (which is basically one of the identical shapes in various angular rotation positions), and does not store these reference models and then compare the image of an object-of-interest (i.e., one of the objects to be picked up by the robot) with the reference models and chose the closest reference model. Since Most particularly, since Greenspan does not even relate to the use of "reference models" as recited, it simply would not be applied to Nishida et al. Thus, Greenspan fails to compensate for the incomplete teaching of Nishida et al.

D. New Independent Claim 10

New claim 10 recites the creation of the reference models, comparing the stored position and posture information thereof with position and posture information of objects-of-interest being captured by the image capturing device, emphasizes what "objects" are being used at what time and includes robotic picking of objects-of-interest. Support for this new claim can be found, e.g., in the claims as filed, and the passages in the specification cited in Section B above.

III. CONCLUSION

In light of the above amendments and remarks, it is respectfully submitted that claims 1-10 are now in condition for allowance.

If there any additional fees associated with filing of this Response, please charge the same to our Deposit Account No. 19-3935.

Finally, if there are any formal matters remaining after this Response, the undersigned would appreciate a telephone conference with the Examiner to attend to these matters.

Respectfully submitted,

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